A STUDY OF THE IMPACT OF
OF IMPROVEMENT OF SCIE
EDUCATION IN SCHOOL

SUMMARY

NATIONAL COUNCIL OF EDUCATIONAL RESEARCH A
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INTRODUCTION

Teaching of Science and Mathematics has always received the highest priority in the scheme of school education It has been reemphasized once again in the National Policy on Education, 1986. The policy document led to the formulation of a scheme of improvement of science education in schools. The scheme came into being in the year 1988 as a Centrally Sponsored Scheme with cent-percent assistance to the state governments for approved purposes The scheme envisaged to cover all government and government aided schools from upper primary to secondary and higher secondary in a phased manner by the end of eighth five year plan. the scheme provides for the following six components

1) Provision of Science Kits to upper primary schools
2) Upgradation and strengthening of Science laboratories in secondary and higher secondary schools,
3) Library assistance to secondary and higher secondary schools,
4) Setting up of District Resource Centres for Science education for teachers' training, development of instructional materials, etc;
5) Training of Science and Mathematics teachers;
6) Assistance to voluntary organisations for undertaking innovative projects and resource support activities in science education.

It was proposed in the scheme that the Central Government as also the State Government would take steps for summative evaluation of implementation of the scheme at the end of plan period so as to ensure that intended benefits were obtained In pursuance of this, the Ministry for Human Resource Development set up a committee vide their order No. F. 20-34/91 Desk (SCE) dated Jan 30, 1992 to look into the various aspects pertaining to quantitative-cum-qualitative evaluation of implementation of the scheme. The report of the committee submitted to the MHRD addressed to eight of the nine objectives proposed for itself The last objective which remained unaddressed aimed at assessing improvement in teaching-learning of science Since this objective is a pivotal one, need for a supplementary study to have a quick appraisal in regard to the impact of the scheme was felt. In view of the urgency, the scope of the study was confined to study the impact of the scheme at secondary stage by drawing samples from the states of Karnataka and Rajasthan.

METHODOLOGY

The present investigation has been accomplished through normative survey method following a cross-sectional approach The variables include students performance in class tenth Board's examination in the subjects of science and mathematics in the years 1988, 1991 and 1994. Besides, perceptions of the teachers, principals, district nodal officers and field investigators in regard to inputs such as training, strengthening of laboratories, updating of libraries, and outputs in terms of development of scientific climate in the school and inculcation of scientific temper amongst students comprised other variables

Sample

The scheme was implemented in the selected schools of 21 districts of Karnataka and 9 districts of Rajasthan 4 districts from each state were randomly selected In all, 120 schools with 20% over sampling were to be selected with proportionate allocation from each district of the state. In the selected districts of Karnataka since the total number of schools covered under the first phase of the scheme was 134, it was decided to select all the schools on cent-percent basis, finally the data came from as many as 132 schools However, in Rajasthan of 433 schools of the selected districts, 120 schools were selected on proportionate basis Finally the data came from as many as 117 schools. The schools were selected on random basis by taking the first number from the table of random number followed by every fourth school in succession thereafter.

Coverage:

The various target groups comprised the District Nodal Officers, Principals, Teachers and Students. State and districtwise details of the target groups are presented in the following table·

Achievement scores of as many as 45,361 students obtained in science and Mathematics subjects at class tenth Boards' examinations (Karnataka & Rajasthan) for the years 1988, 1991 and 1994 were collected

Besides, observations of as many as 45 faculty members of the Regional Colleges of Education, Ajmer & Mysore who visited the schools for the purposes of data collection in respect of various input variables were also used for focussed interpretation of data.

Tools:

Five tools namely, Principal Questionnaire, Teacher Questionnaire, District Nodal Officer Questionnaire, Achievement Proforma and School Visit Report Proforma were employed for data collection purposes. The data were collected with the help of professionally trained personnel drawn from the faculty of the Regional Colleges of Education, Mysore and Ajmer

Analysis:

As a part of analyses, responses provided by the teachers and principals were used to generate as many as 16 indices, 8 each for teachers and principals These indices were further synchronised to seven indices for focused interpretation of data The indices so generated are as under

1 Training Input Index (TII)
2 Learning Material Index (LMI)
3. Infrastructural Facility Index (IFI)
4. School Scientific Climate Index (SSCI)
5 Scientific Temper Index (STI)
6 Science Teaching Improvement Index (STII)
7 Mathematics Teaching Improvement Index (MTII)

Coverage of the Target Group

States/ Districts		KARNATAKA					RAJASTHAN					
Target Groups		Dakshina Kannada	Mandya	Bellary	Coorg	Total	Nagaur	Udaipur	Bilwara	Jhalawar	Total	Grand Total
District Nodal Officers		1	1	1	1	4	1	1	1	1	4	8
Principals		67	32	14	19	132	35	52	16	14	117	249
Teachers		229	100	48	67	444	70	118	37	34	259	703
Students	1988	4387	1839	930	1073	8229	1226	2248	624	689	4787	13016
	1991	4614	2484	1000	1078	9176	1954	2614	734	1146	6448	15624
	1994	5076	2691	1076	1112	9955	2092	2646	834	1194	6766	16721

The aforesaid indices were compared for schools with full and partial inputs under the scheme

Achievement scores of as many as 45,361 students obtained in science and mathematics at class - X boards' examination in the years 1988, 1991 and 1994 were analysed so as to compare the pass percentages against state results District and yearwise comparisons of mean achievement in science and mathematics were also attempted for both the states Besides, mean achievement scores of students in both the subjects were also compared in respect of schools with full inputs and partial inputs Data were also examined to study the relationship between input and output variables.

TRAINING OF TEACHERS & DEVELOPMENT OF INSTRUCTIONAL MATERIAL

Training of teachers & development of instructional material constitute significant inputs for improving the quality of science education in schools A careful examination of the data received from various quarters in regard to these inputs indicates diversity of observations.

Teachers observations:

Only one-fourth of the teachers in Karnataka and Rajasthan received training under the scheme Of them, 56% in Karnataka and 32% in Rajasthan received recurrent training. Training provided was perceived to be of average level by the teachers of both the states. One-third of the teachers from Karnataka and two-third of the teachers from Rajasthan reported to have received reference material during the training Most of the teacher found the training inadequate, insufficient and not according to curriculum in force

Principals' Observations:

Less than fifty percent of the principals reported that teachers of their schools were trained under the scheme. One-third of the principals from Karnataka and more than two-third from Rajasthan opined that reading material was supplied to the teachers during the training. 48% of the principals from Karnataka and 70% from Rajasthan considered the training to be adequate About one-fourth of the principals from Karnataka and two-third from Rajasthan reported that one of the components of teachers' training was the use of laboratory equipment. Principals were of the opinion that recurrent and rigorous training should be provided to the teachers

Nodal Officers' Observations:

In Karnataka only two six-day training programmes were conducted, wherein 65 teachers were trained In Rajasthan 17 programmes of 10-15 day duration were organised wherein as many as 605 science teachers and 596 mathematics teachers were trained Involvement of trainees was reported to be high in both the states In Karnataka, time allocation for practical work was reported to be average while in Rajasthan it was high. In Karnataka, quality of material supplied was rated as low, while in Rajasthan it was rated as average Funds for training were not received in time. In Karnataka, training was conducted immediately after the receipt of funds, while in Rajasthan this was not the case Nodal Officers of Karnataka indicated the non-availability of trained Resource Persons, while in case of Rajasthan lack of follow-up was the major concern

RCE Faculty Observations:

About two-third of the schools were without any science teachers trained under the scheme, observed the faculty of the RCEs Similar was the position regarding mathematics teachers About one-fourth of the schools were having only one teacher of science trained under the scheme Training was perceived to be mostly theoretical

Development of Instructional Material at DRCs

This is the weakest part of the implementation of the scheme, as no material was developed at any of the DRCs, as reported by the Nodal Officers

LEARNING MATERIAL AND INFRASTRUCTURAL FACILITIES

One of the significant inputs envisaged in the scheme pertains to supply of science equipment and books for the purposes of strengthening the laboratory and library facilities. Analyses of perceptions of teachers, principals, district-nodal officer and RCEs faculty in regard to these variables yield diversified results

Upgradation of Laboratory:

As many as 284 teachers (64%) from Karnataka and 120 teachers (46.3%) from Rajasthan confirmed that equipment were received in their schools However, they were critical in so far as the quantity and the quality of the equipment were concerned and demanded modifications in the present policy

The mean principal perception about science equipment (PPSE) scores were found to be below average in both the states Unlike Karnataka, principals of schools with full inputs in the state of Rajasthan were found to possess significantly higher perception about science equipment. However, principals from both the states were found to be on the same wave length as far as the facilities like separate laboratory, placement of laboratory assistant and quality of equipment as per the existing curriculum were concerned

Three of the four nodal officers observed that the equipment were procured through direct purchase at school level in the state of Karnataka while at state level in Rajasthan They observed that funds received on account of laboratory equipment were judiciously utilized Besides, they were of the opinion that provision should be made for maintenance and replacement of the equipment. Officers of the RCEs while collecting the data observed that there were no proper laboratories and the equipment were not in use in most of the places.

Upgradation of Library

As many as 355 teachers (80%) from Karnataka and 133 teachers (51.4%) from Rajasthan confirmed the supply of books under the scheme. An increase in the number of books to the tune of 151 per school in Karnataka and 146 per school in Rajasthan was observed.

Most of the teachers from Karnataka pointed out the inadequacy of Kannada medium books especially corresponding to the curriculum Teachers from both the states observed inadequacy of space and proper facilities to keep up the books about 45% principals from Karnataka and 53% from

Rajasthan observed about the supply of books numbering upto 200 both in the areas of science and mathematics Against this, 22% from Karnataka and 25% from Rajasthan observed that no books were supplied under the scheme About 67% principal from the both the states opined the use of books by the students. District Nodal Officers of both the states observed that library materials were supplied, as per the state list, by the state agencies Divergent views were obtained on the issue of use of library materials by students. They observed some short comings in supply of learning materials which need to be augmented. Officers of the RCEs observed inadequate supply of books, lack of their relevance to curriculum, inappropriate issuing facilities etc.

Comparison of Learning Material Index (LMI) for schools with full and partial inputs indicates that full inputs of the scheme have been helpful in enhancing the perception of teachers and principals about the materials supplied.

Infrastructural Facilities

Teachers from both the states observed lack of basic facilities such as power, water, gas, furniture, storage, supporting staff and provision for maintenance and replacement of materials. Principals appeared to have given divergent opinions. The situation appears to be relatively grave in Karnataka so far as physical facilities are concerned In Rajasthan also the picture is not good There the available materials and manpower resources seems to have not been put to effective use The supply of equipment and learning materials need to be regulated on the basis of local requirements

Administrative & Financial Support

Majority of the principals from both the states opted out to comment on administrative and financial support system of the scheme. Some of them expressed their concerns on issues like shortage of science and mathematics teachers, transfer of trained teachers, not filling up of vacant posts, non-availability of librarians & laboratory attendants, shortage of funds for maintenance and replacement of equipment etc.

Monitoring

It is evident from the observations made by the district nodal officers that yearly mode of monitoring was followed in the state of Karnataka. In Rajasthan, non-response from two of the nodal officers and differing assertions from the remaining two raise doubts about proper monitoring mechanism In fact none of the states under reference seemed to have adhered to the stipulations made in this regard under the scheme wherein a quarterly monitoring mode was emphasized

IMPACT OF THE SCHEME ON SCIENTIFIC CLIMATE & SCIENTIFIC TEMPER

The scheme of improvement of science education in schools was based on the basic premise that it would help develop scientific climate in schools and inculcate scientific temper amongst students. This would ultimately lead to improving quality of science education in schools. A close scrutiny of the data received from different quarters in this regard discloses varied experiences.

Teachers' Perception of Scientific Climate (TPSC)

Very few teachers from both the states reported frequent organisation of science related activities About 79% teachers from Karnataka and 74% teachers from Rajasthan reported rare or no organisation of science exhibitions Organisation of talks by scientists is also a rare phenomenon in both the states, just like organisation of science excursion In Karnataka, there is no difference in TPSC scores of teachers from schools with full and partial inputs, while in Rajasthan the difference is highly significant (significant at 01 level) in favour of full input schools However the higher TPSC scores of Karnataka than Rajasthan, indicate that scientific climate in the schools of Karnataka is improving whereas in case of Rajasthan this is true with schools having full input.

Principals' Perception of Scientific Climate (PPSC)

As in the case of teachers, only about one-third of the principals reported frequent organisation of science related activities Here also, talks by scientists and organisation of science excursions is a rare phenomenon Again, in Rajasthan there is significantly higher PPSC score in the schools having full inputs as compared to those with partial inputs, while in Karnataka it is the same in both the cases but higher than that of Rajasthan schools having partial inputs.

The results pertaining to SSCI, appear to follow the pattern of TPSC and PPSC

The district nodal officers as well as visiting RCE faculty members also reported an average scientific climate in the schools with lack of efforts on the part of teachers However, the RCE faculty reported that it was due to heavy workload, lack of competency, lack of interest and motivation amongst teachers

Teachers Perception of Scientific Temper (TPST)

The scientific temper in both the states was found to be below average It was lowest in case of Rajasthan schools having partial inputs While there is no significant difference in TPST scores of the schools of Karnataka having full and partial inputs, it is highly significant in the case of Rajasthan in favour of schools having full input.

Principals' Perception of Scientific Temper (PPST)

Principals of the schools of both the states have also perceived below average scientific temper in the schools with no difference in the PPST scores of schools with full and partial inputs

STI also indicated below average perception with significantly lower perception in case of schools of Rajasthan having partial inputs District Nodal Officers also reported just an average scientific temper amongst the students of both the states.

Impact of the Scheme on Improvement of Teaching of Science and Mathematics and Student Achievement

The scheme of improvement of science education in schools aims at increasing number of learners with increased learning in the areas of science and mathematics by improving the quality of teaching and learning. Comparisons of perceptions in terms of indices TPTS, PPTS, STII, TPTM, PPTM and MTII were made for schools with full and partial inputs in both the states. The findings so obtained are given as under·

Teachers' Perception about Improvement in Teaching of Science (TPTS)

The improvement in teaching of science was just below average in both the states. The improvement was more in schools with full inputs as compared to that of partial inputs. However, the difference in improvement turned out to be significant only in the state of Rajasthan where the inputs have resulted in the improvement of teaching of science.

Principals' Perception about Improvement in Teaching of Science (PPTS)

In both the states, the improvement was observed to be above average in schools with full inputs and below average in schools with partial inputs Here also, the variation turned out to be significant only in the state of Rajasthan Thus increased inputs appears to have improved the teaching of science

Science Teaching Improvement Index (STII) also indicated that improvement in science teaching was directly related to the level of inputs in the schools District nodal officers also reported moderate improvement in the teaching of science as well as the teachers' motivation. They reported moderate to high level of increase in the teaching skills of science teachers

Teachers' Perception about Improvement in Teaching of Mathematics (TPTM)

The improvement in teaching of mathematics was observed to be below average in both the states Here also, the improvement in teaching of mathematics was better in the schools with full inputs than with partial input. As the variation was found to be significant in both the states, it may be stated that the inputs under the scheme had enhanced the improvement of teaching of mathematics.

Principals' Perception about Improvement in Teaching of Mathematics (PPTM)

Improvement in teaching of mathematics in both the states was perceived to be above average in schools with full inputs The schools having partial input were perceived to register below average improvement This variation was observed to be significantly high only in the state of Rajasthan

Mathematics Teaching Improvement Index (MTII) in both the states was found to be significantly higher in schools with full input than with partial inputs It indicates that the inputs provided to the schools resulted in the improvement of teaching of mathematics in both the states

District nodal officers also reported moderate improvement in the teaching of mathematics, as well as motivation of teachers of mathematics. Increase in the teaching skills of mathematics teachers was reported to be moderate to high in both the states by district nodal officers.

Impact of the Scheme on Students Achievement in Science and Mathematics:

Impact on pass-percentage.

Comparisons of pass percentages of science and mathematics for the years 1988, 1991 and 1994 of the students of sampled schools and the schools of the entire Board yielded following results·

- The pass percentage of scheme schools both in science and mathematics turned out to be always higher than the Board's pass percentage in both the states

- In Karnataka, the pass percentage of the scheme schools in both the subjects showed improvement in the period 1988 to 1991, while it declined during the period 1991 to 1994. The Board's pass percentage also showed the same trend
- In Rajasthan, the pass percentage of the scheme schools in both the subjects declined during 1988 to 1991 and then improved during 1991 to 1994. Here also, the Board's pass percentage also showed the same trend This improvement turned out to be quite sharp in science subject.

Impact on Mean Achievement Scores in Science and Mathematics for Scheme Schools in Karnataka

In all the four districts, the mean achievement score of students of scheme schools showed good improvement in both the subjects from 1988 to 1991. This trend got reversed in the period 1991 to 1994 However, in spite of the decline in the later period, the mean achievement in 1994 in the two subjects was better than that of 1988 It shows that the tempo of the scheme which yielded good results in the initial years died down in later years due to lack of adequate inputs and proper monitoring.

Impact on mean achievement scores in Science and Mathematics for Scheme Schools in Rajasthan

In all the four districts, the mean achievements of students in the two subject declined during 1988 to 1991 In fact this was the period of providing the inputs to different schools, which extended even beyond 1991 So the decline was not due to the scheme, but as a result of some extraneous factors. However, after the schools were provided with the inputs by 1991-92, the achievement scores showed good improvement during the period 1991 to 1994, both in science and mathematics in all the districts, excepting Jhalawar District wherein achievement in Mathematics remained static

Impact on students' achievement in terms of full and partial inputs

In Karnataka, the full and partial input schools varied only in terms of teachers' training, as the science equipment and books were supplied to almost all the schools The difference, therefore, may be attributed to teachers' training input provided under the scheme. Here, the students belonging to partial input schools showed better achievement than those of full input schools irrespective of subject and the year It signifies that the training provided to teachers showed little impact on the achievement of students It may perhaps be due to the inadequacies of the training programmes conducted in the state In Rajasthan, the variations in schools with full and partial inputs appeared to be due to either of the three inputs namely, teachers training, science equipment and books supplied. Here, the achievement of students belonging to full inputs schools always showed better performance than those form partial input schools

Relationships between input and output variables of the scheme in the state of Karnataka

There was significantly high correlation between the 3 input indices viz , TII, LMI and IFI, and the 4 output indices viz., SSCI, STI, STII and MTII The relationship of teachers training and learning material indices with improvement in teaching of science and mathematics turned out to be quite high Since the learning material was provided in all the schools, the training inputs needed to be enhanced for the improvement of teaching of science and mathematics.

The achievement of students in science and mathematics showed significant relationship with the infrastructural facilities index Therefore, it signifies that this aspect too needs to be strengthened for the improvement of achievement in science and mathematics

Relationship between input and output variables of the scheme in the state of Rajasthan

In Rajasthan only learning material and infrastructural facility indices turned out to be significantly related to the 4 output indices, namely, SSCI, STI, STII and MTII. This was particularly high in case of learning material index As in the case of Karnataka, the achievement of students in science and mathematics showed positive relationship with infrastructural facility index.

CONCLUSIONS AND SUGGESTIONS

Prior to drawing conclusions and offering suggestions, major findings of the study and shortcomings in the implementation of the scheme are listed as under:

Major Findings:

The major findings of the study of the scheme of improvement of science education in schools are given below

1 Only one fourth of the teachers in Karnataka and Rajasthan received training under the scheme

2 Training provided under the scheme was perceived to be of average level by the teachers in both the states.

3 Only one-third of the teachers from Karnataka and two-third from Rajasthan reported to have received the reference material during the training

4 48% of the principals from Karnataka and 70% from Rajasthan considered the training of teachers to be adequate, while most of the teachers reported it to be inadequate.

5 64% teachers from Karnataka and 46 3% teachers from Rajasthan confirmed the receipt of science equipment in their schools

6. In Rajasthan, principals of schools with full inputs were found to possess significantly higher perceptions about science equipment

7. 80% teachers from Karnataka and 51.4% teachers from Rajasthan confirmed the supply of books under the scheme

8. An average increase in number of books to the tune of 151 per school in Karnataka and 146 per school in Rajasthan was observed

9 Most of the teachers from Karnataka pointed out the inadequacy of Kannada medium books in the school library.

10 Full inputs of the scheme proved to be helpful in enhancing the perception of teachers and principals about the learning material supplied.

11. The scientific climate in all the schools of Karnataka seemed to have improved while in Rajasthan this came true only with schools having full inputs

12 The scientific temper of the students was better for schools with full inputs in Rajasthan, while it was almost the same for both types of schools in Karnataka.

13 The improvement in teaching of science, though below average in both the states, was found to be better in schools with full inputs, as compared to partial input schools.

14 Science teaching improvement Index (STII) indicated that improvement in science teaching was directly related to the level of inputs in the schools.

15 The improvement in teaching of mathematics was also found to be better in schools with full inputs MTII also indicated that the improvement in mathematics teaching was directly related to the level of inputs in the schools.

16 In Karnataka, the pass percentage in respect of scheme schools showed improvement in both the subjects from 1988 to 1991, while it declined during the period 1991 to 1994. The same trend was observed in the Board's result also

17 In Rajasthan unlike Karnataka, the pass percentage in respect of scheme schools showed improvement in both the subjects in the later phase of the implementation of the scheme (1991 to 1994) Improvement in science subject turned out to be quite sharp

18. The scheme in Karnataka showed improvement in the achievement scores in the initial years, but it died down in the later years perhaps due to lack of adequate inputs and proper monitoring

19. In Rajasthan since the inputs were delayed, the scheme registered improvement in achievement scores in the later years.

20 Full input schools in Karnataka could not make an edge over partial input schools. It signifies the ineffectiveness of training, which was the only additional input in full input schools.

21. In Rajasthan, students belonging to full input schools exhibited better performance than those from partial input schools

22 There was significantly high correlation between the three input variables, namely, TII, LMI and IFI, and the four output indices, namely, SSCI, STI, STII and MTII in Karnataka.

23 In Rajasthan, only learning material and infrastructural facility indices turned out to be significantly related to the 4 output indices viz., SSCI, STI, STII and MTII.

24 The achievement of students in science and mathematics showed good relationship with the infrastructural facility index in both the states.

Major Shortcomings

Based on the findings of the present study, the following shortcomings were noticed with regard to the implementation of the scheme in the states of Karnataka and Rajasthan.

- The scheme seems to have been implemented in a disorganized manner in both the states as the pace of providing inputs has not been uniform within and across the states.
- It appears that no proper decision was taken with regard to placement policy of teachers, particularly with regard to filling up of the vacant posts of teachers and retention of trained teachers in scheme schools.
- There was a general complaint with regard to non- availability of funds for maintenance and replacement of equipment etc
- No proper monitoring system appeared to have been followed in either of the states. Even the stipulations mentioned in the scheme were not adhered to
- No systematic attempt was made to bring all teachers into the fold of training in the current plan period Further, some of the teachers underwent second and third training course without completion of the first cycle.
- There does not appear to be well designed and field tested training package in either of the states
- The methodology of organizing teachers training camps was not based on a sound training design, developed in advance.
- The supply of equipment and books has been erratic and not in tune with the curricular requirements and needs of the schools
- No attempt was made in either of the states to ensuring minimum infrastructural facilities
- A little care seems to have been taken in both the states to develop awareness amongst Science and Mathematics teachers about organising various activities which may result into development of scientific climate in the schools and inculcation of scientific temper amongst students.
- No scheme for enhancing teachers' motivation was in effect in either of the states as part of the main scheme of improvement of science education in the schools of the country.
- Changes in syllabi in the states were not taken into account in the course of implementation of the scheme
- There exists no proper system for assessing varied needs of the schools on regular basis.

Conclusions:

In the light of the major findings of the study and the bottlenecks in the implementation of the scheme, following conclusions have been drawn

Full inputs provided for under the scheme namely teachers' training, science equipment and books and infrastructural facilities did not reach in most of the schools Of all the components of the scheme, the training of teachers has proved to be the weakest one in terms of both quantity and quality. Not only this, the training has also been delayed in both the states The scheme has not been monitored properly. The stipulated mode of quarterly monitoring has not been adhered to. Lack of basic infrastructural facilities like laboratory, library, storage facility, man power support and funds for the maintenance and repair of the equipment has greatly hampered the use of the material supplied in the schools Besides, the learning material supplied under the scheme has not been able to cater to the local specific requirements.

As regards generating scientific climate in schools, inculcating scientific temper amongst students and improving teaching of science and mathematics, full input schools have made an edge over the partial input schools.

In so far as the performance of students in science and mathematics are concerned, the scheme schools have shown better pass percentage than the pass percentage of the respective Boards

In the state of Karnataka there has been an improvement in the achievement levels of the students in the year 1991 as compared to that of the year 1988. However, the gains registered during the initial years of the implementation of the scheme have died down during the later years. This may be attributed to lack of adequate inputs and proper monitoring. Some how the picture in the state of Rajasthan has turned out to be different than that of Karnataka. There the scheme seems to have taken longer time to take off and as such the scheme has shown improved achievement in the year 1994 as compared to that of the year 1991

The three input variables namely teachers' training, learning materials and infrastructural facilities have shown good positive relationship with the four output variables, viz., school scientific climate, scientific temper, improvement in teaching of science and that of mathematics Besides, the achievement of students in science and mathematics has shown good relationship with the infrastructural facilities available in the schools

In view of the findings of the study, it may be inferred that the scheme is extremely useful and has enormous potential to generate scientific climate in the schools, to inculcate scientific temper amongst students and to improve teaching & learning of science and mathematics provided its implementation ensures proper training of teachers, adequate infrastructural facilities and rigorous monitoring

Suggestions

An overview of the present piece of research provides an opportunity of taking an advantage of the experiences of the implementation of the scheme in the current five year plan. Suggestions emanating out of it are presented as under·

- Baseline assessment of infrastructural facilities and needs of schools should form the basis of the implementation of the scheme in the states
- Inputs of the scheme should go into the system in a coordinated manner
- A proper transfer and placement policy should be practised so as to avoid loss of training
- Availability of funds should be regulated by following a predesigned time schedule.
- Management Information System (MIS) needs to be developed with regard to implementation of the scheme and it should be fully exploited for monitoring purposes
- Proper training design and training package should be developed and its practice be ensured.
- The supply of equipment and books should be commensurate with the curricular and physical needs of the system.
- Proper infrastructural facilities, their upkeep and maintenance should constitute an important ingredient of the scheme
- The teacher training programme should invariably include enrichment of content knowledge, pedagogical skills and awareness of the components and skills to gear them up for developing scientific climate in schools and inculcating scientific temper amongst students
- The training design should take care of the appropriate duration, coverage, time slots, group size, practical work and its periodicity, its methodology and specifications of qualities and experience of resource persons etc. etc
- Schemes comprising awards/competitions for teachers need to be introduced as part of the main scheme to enhance and sustain teacher motivation
- A mechanism to incorporate curricular changes into the scheme and vice-versa needs to be developed
- Exercise for regular assessment of scheme implementation and enforcing mid term corrections, if any, be undertaken
- Mechanism of utilizing the feedback in terms of quantity and quality of inputs and their effect on process and product oriented variables should be evolved and put to practice.
- Concern for quality should be reflected in both inputs and outputs envisaged under the scheme.

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